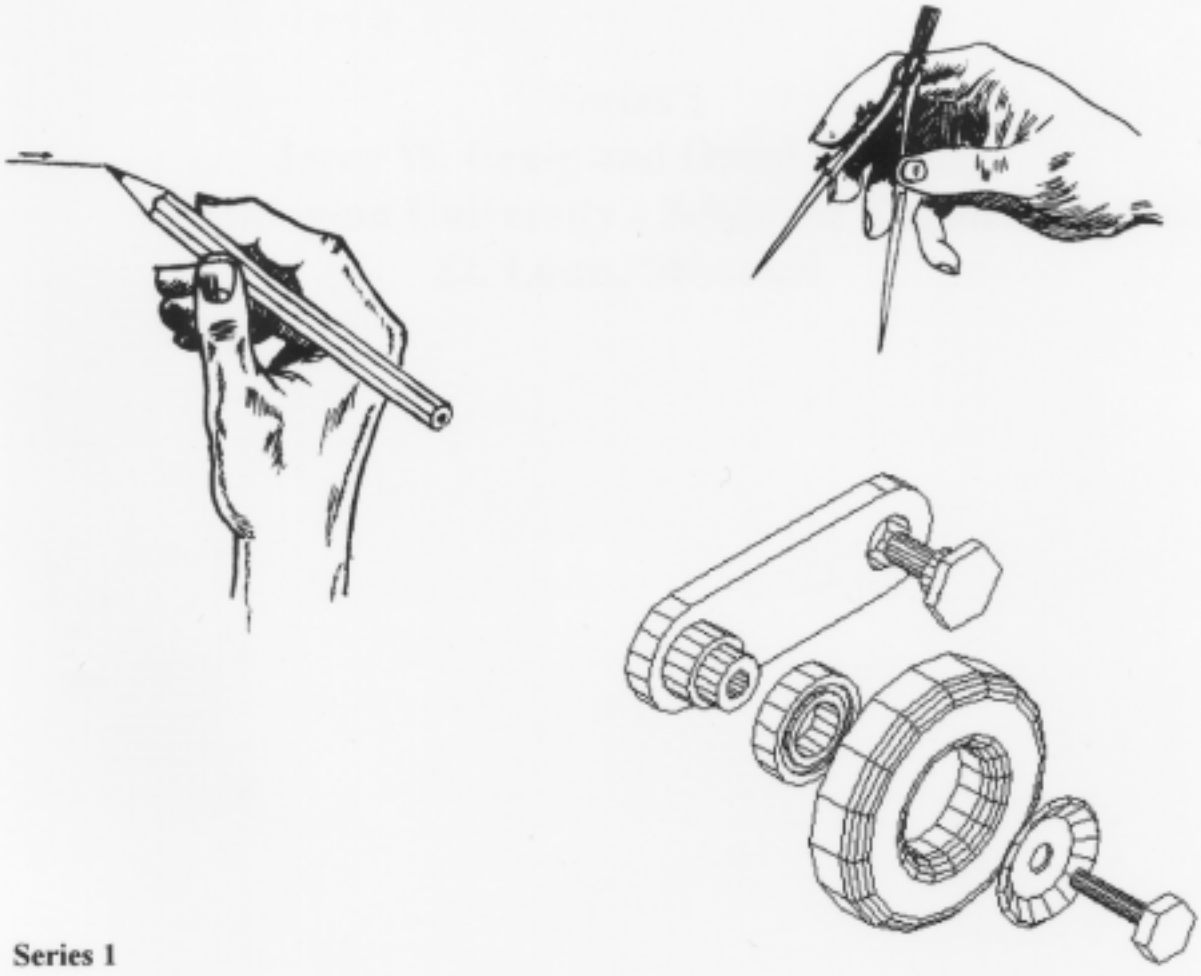
Engineering Graphics Workbook

By
Jerry W. Craig and Orval B. Craig



Series 1

Schroff Development Corporation

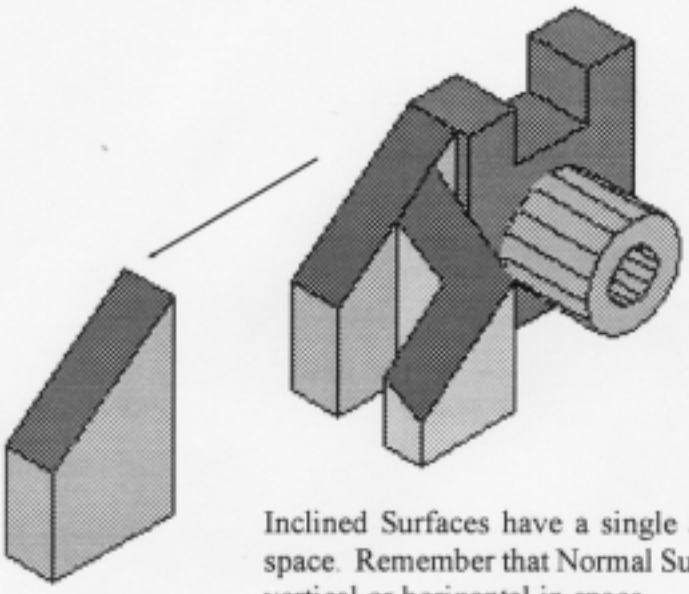
Note from the publisher:

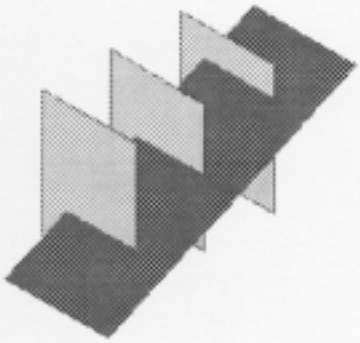
The pages in this PDF file are scanned images and do not accurately demonstrate print quality and legibility of the text and annotations.

Pages 14, 16, 18, 20 22, 24, 26 and 28 are blank sketching sheets, similar to pages 10 and 12, and have been omitted from the PDF file.

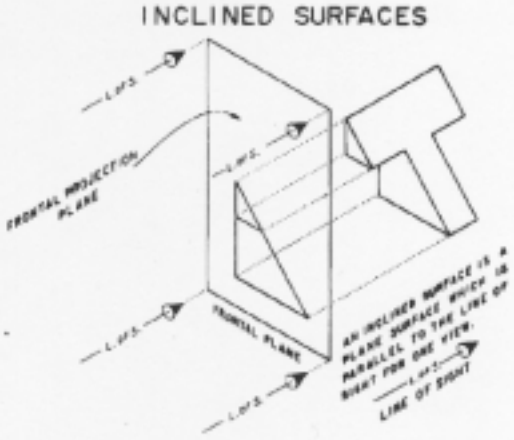
Thank you for your interest in our textbooks.

Introduction to Inclined Surfaces

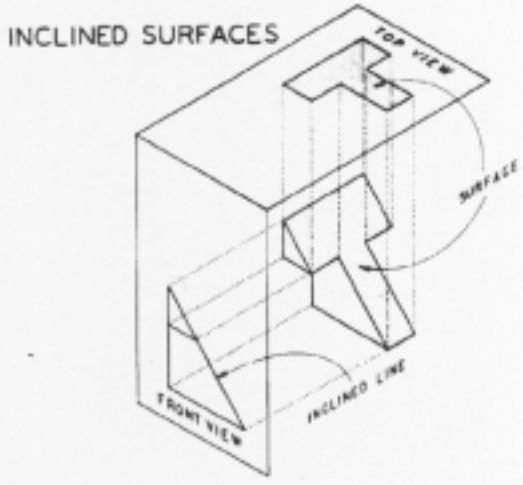




Inclined Surfaces have a single angular slant in space. Remember that Normal Surfaces are either vertical or horizontal in space.



Inclined Surfaces appear as an inclined edge-of-surface in one view. In this example, the "T" shaped surface is set parallel to the lines of sight for the front view.

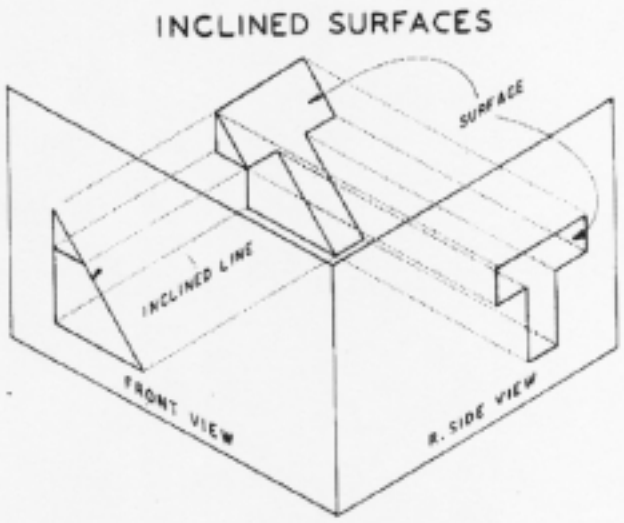


Projecting surface "T" to the top view will show the surface, but it will appear shorter than its actual extent. Surface "T" is classified as foreshortened in the top view.

Looking at the side view, surface "T" appears as a foreshortened surface.

Analyzing Inclined surfaces starts by picking an inclined line in one view.

An Inclined line in one view may be the edge-of surface view of an Inclined surface on an object.

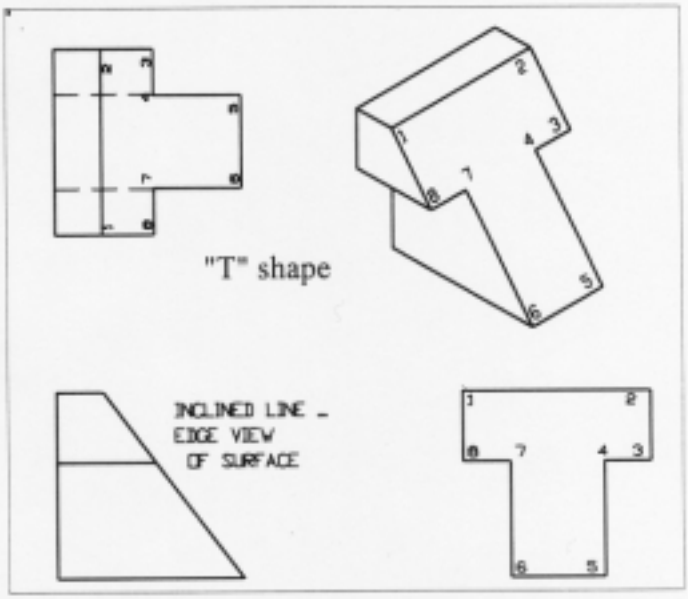


Three possible Inclined surface views.

1. Inclined edge-of-surface in the front view.

Surface "T" appears as an inclined edge-of-surface in the front view. It will appears as a foreshortened surface in the top view and as a foreshortened surface in the side view.

An Inclined surface will always have the same general shape whenever it appears as a surface.



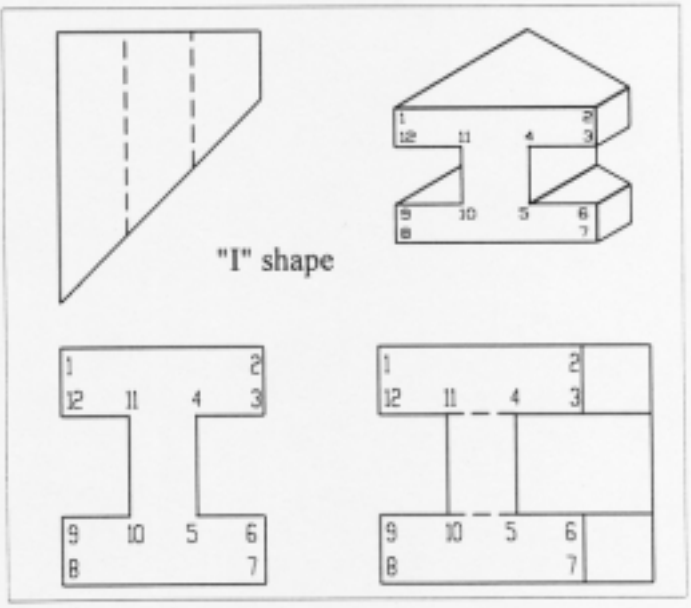
2. Inclined edge-of-surface in the top view.

Surface "I" appears as an inclined edge-of-surface in the top view. It will appear as a foreshortened surface in the front view and a foreshortened surface in the side view.

An Inclined surface will always have the same number of corners and edges whenever it appears as a surface.

Surface "I" has 12 corners and edges in each surface view.

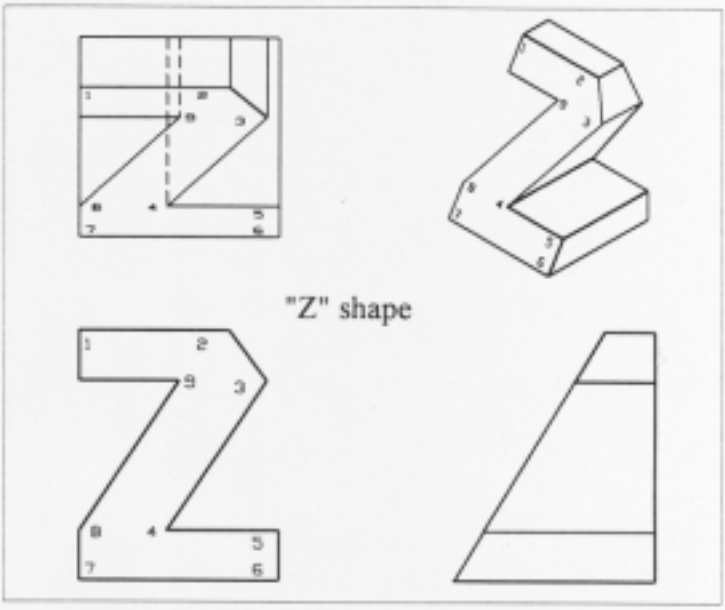
Numbering the corners of an Inclined surface will help assure that all corners are correctly drawn.



3. Inclined surface appearing as an inclined edge-of-surface in the side view.

Surface "Z" appears as an inclined line in the side view. It is a surface in the front and top views.

Inclined surfaces must have the same parallel and non-parallel edges whenever they appear as surfaces.



This is the complete Inclined Surface Chart. It is easier to remember than the Normal Surface Chart. Usually, if there is an inclined line in one view, it will be the edge of an inclined surface appearing in the other views.

INCLINED SURFACES

FRONT	TOP	SIDE
INCLINED LINE	SURFACE	SURFACE
SURFACE	INCLINED LINE	SURFACE
SURFACE	SURFACE	INCLINED LINE

INCLINED LINES ARE TRUE LENGTH LINES
SURFACES ARE FORESHORTENED

PROVING INCLINED SURFACES

1. INCLINED LINE IN ONE VIEW — SURFACE IN THE OTHER TWO VIEWS.
2. SURFACE MUST HAVE SAME GENERAL SHAPE.
3. SURFACES MUST HAVE SAME NUMBER OF CORNERS AND EDGES.
4. SURFACES MUST HAVE THE SAME PARALLELISM AND NON PARALLELISM OF EDGES.

Analyze the surfaces on this part:

"A" (1,2,3,4,5) is an inclined line in the side view. It is a surface in the front and top views.

"B" (3,6,7,8,4) is an inclined line in the top view. It is a surface in the front and side views.

"C" (2,10,11,6,3) is an inclined line in the front view. It is a surface in the top and side views.

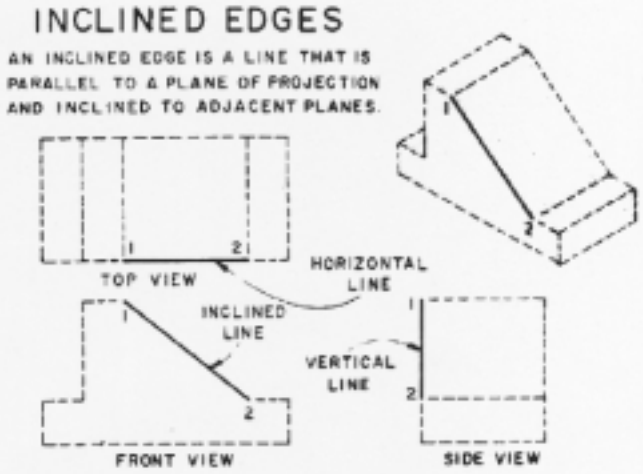
"D", "F" and "G" are normal surfaces.

Analyzing Inclined Edges

An Inclined edge will appear as an inclined line in one view and will be either vertical or horizontal in the other views.

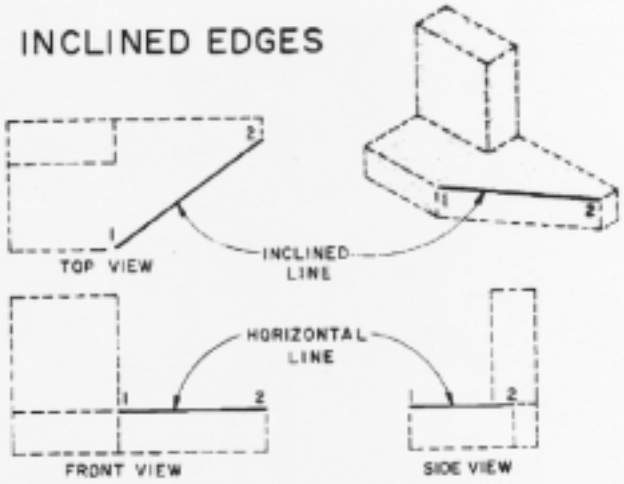
Line 1,2 is parallel to the front projection plane in this example. It is horizontal in the top view and vertical in the side view.

Line 1,2 is true length in the front view.



Inclined line 1,2 is parallel to the top projection plane. It is true length in the top view.

Line 1,2 is horizontal in the front and side views and is foreshortened in those views.



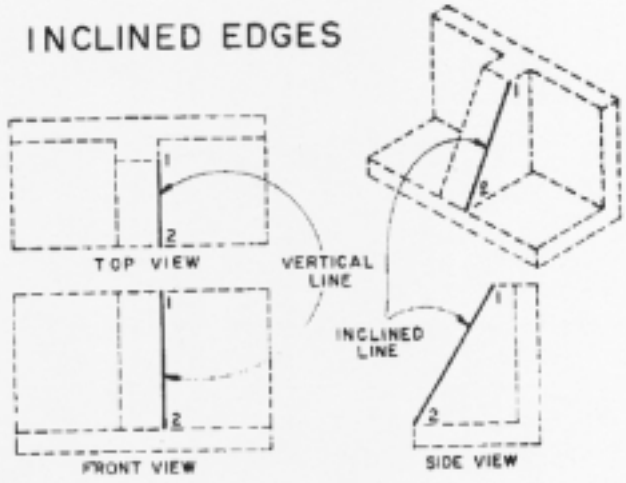
INCLINED EDGES

FRONT	TOP	SIDE
INCLINED LINE	HORIZONTAL LINE	VERTICAL LINE
HORIZONTAL LINE	INCLINED LINE	HORIZONTAL LINE
VERTICAL LINE	VERTICAL LINE	INCLINED LINE

INCLINED LINES ARE TRUE LENGTH LINES
HORIZONTAL AND VERTICAL LINES
ARE FORESHORTENED

Inclined edge chart. It is important to know when a line appears <u>true length</u> in a view.

Inclined line 1,2 in this example is parallel to the side projection plane. It is a vertical foreshortened line in the front and top views.

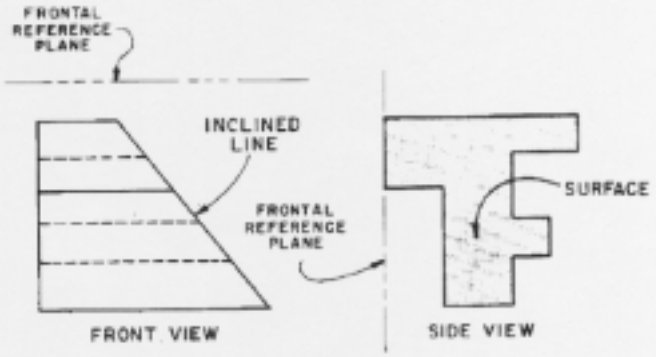


Projecting Inclined Surfaces

Given: Front and Side views are complete.

Draw: Top view.

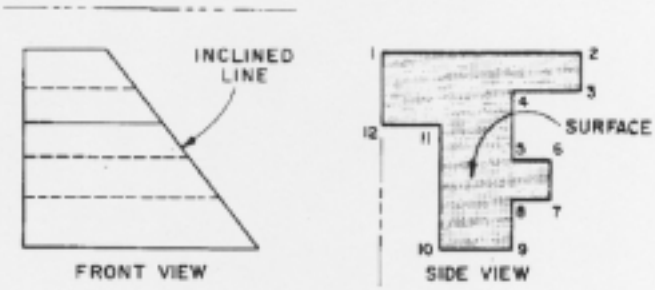
1. Locate reference for measurements. Sketch a vertical line in the side view. Sketch a horizontal line in the top view. DEPTH is the common dimension from side to top views.



2. Identify an inclined line in the front view. It is surface "F" in the side view.

3. Number the corners of the surface in the side view. Be sure to place a number at each corner. Do not duplicate numbers.

Surface "F" has 12 corners and edges.

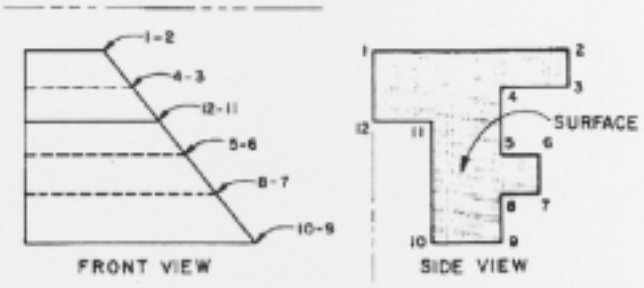


4. Locate the numbers on the inclined line in the front view.

The inclined line in the front view <u>is</u> the surface in the side view. All the numbers on the surface in the side view must be on the inclined line in the front view and <u>no place else</u>.

Drawing surface "F" in the top view becomes an automatic process.

__ Project the points from the front view.
__ Measure the points from the side view.



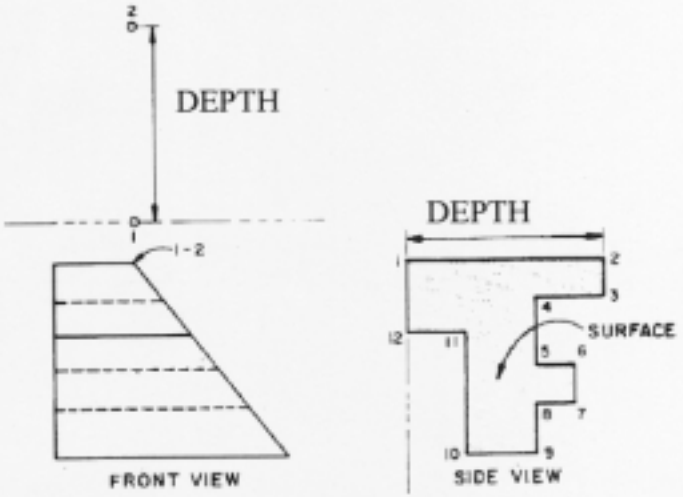
Transfer point 1 to the top view.

__1 projects up from the front view.
__1 is on the reference in the side view.
__1 is on the reference in the top view.

Transfer point 2 to the top view.

__2 projects from the front view.
__2 is the full depth (horizontal) in the side view.
__2 is the full depth (vertical) in the top view.

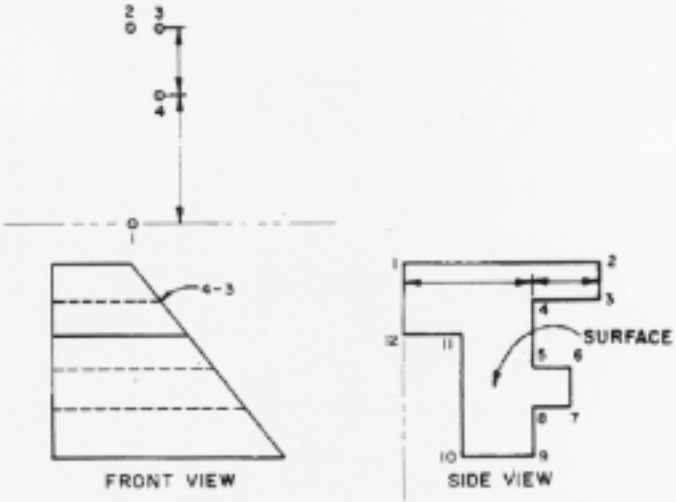
Put a dot and label each point in the top view.



Project points 3 and 4 to the top view.

Measure the depth distances (horizontal) in the side view. Transfer the same distances (vertical) to the top view.

Place a dot and carefully label the points in the top view.



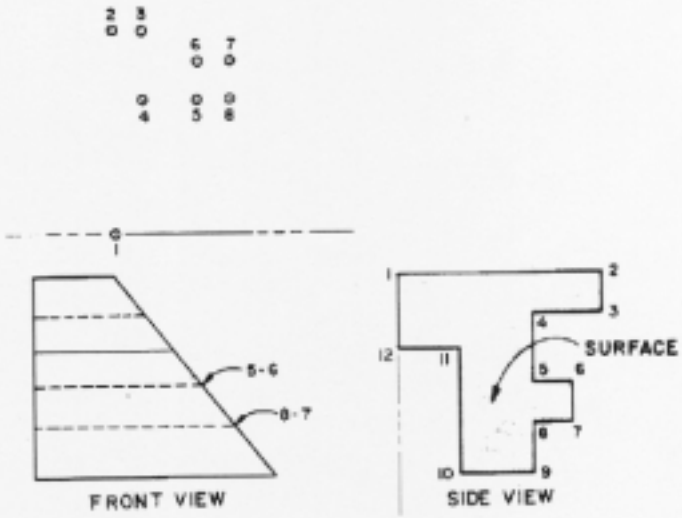
Transfer 5,6,7,8 to the top view.

Project the points from the front view.

Measure the distances from the side view.

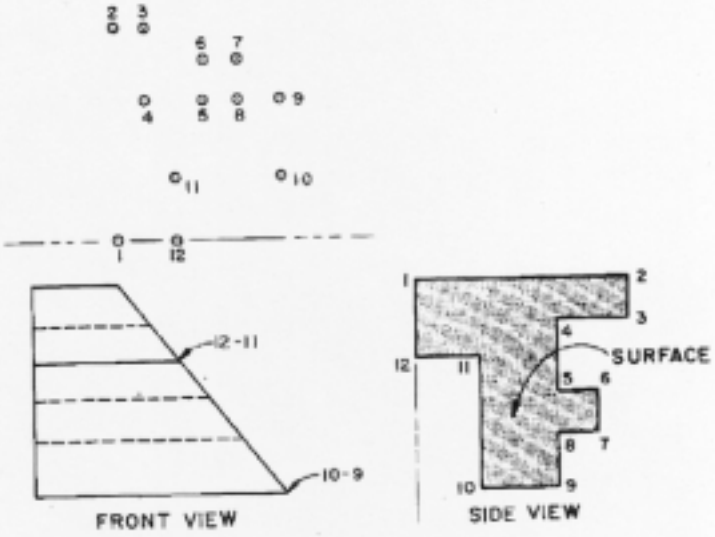
Transfer the measurements to the top view.

Locate each point with a dot and carefully label each point in the top view.



All the points have been transferred to the top view and labeled.

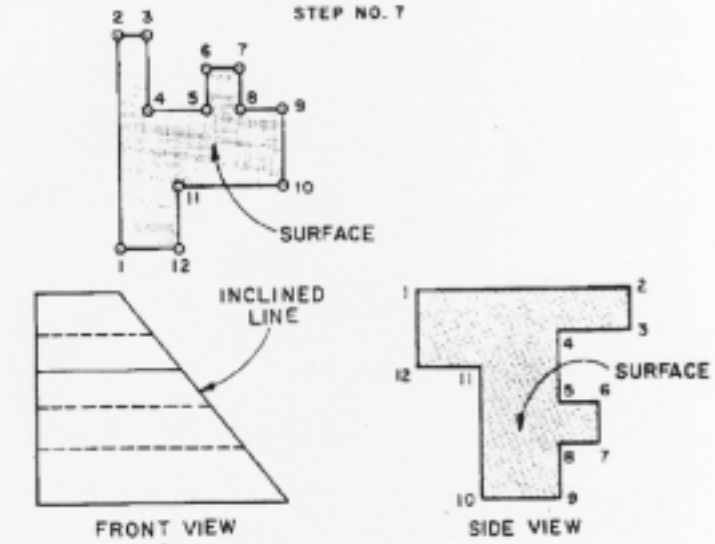
This process makes it possible to create portions of a missing view before the shape can be visualized. This is an excellent means of developing the ability to visualize complex shapes.



Connect the points in the same order they were connected in the side view.

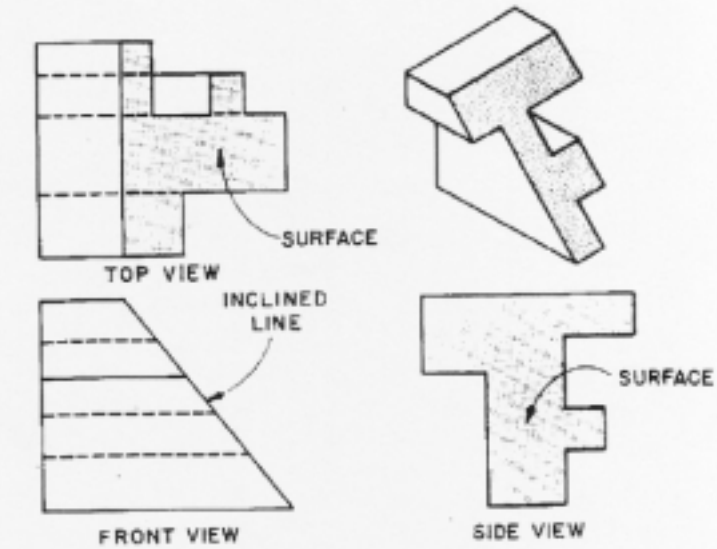
Inclined surface "F" has been transferred to the top view. It must have:

__The same number of corners and edges.
__The same parallel edges.
__The same general shape in each surface view.



Thirteen surfaces must still be analyzed and drawn to complete the top view. These are all Normal Surfaces.

__Six horizontal lines in the side view must be horizontal lines in the front view and surfaces in the top view.
__Six Vertical lines in the side view must be surfaces in the front view and horizontal lines in the top view.
__A vertical line in the front view must be a surface in the side view and a vertical line in the top view.

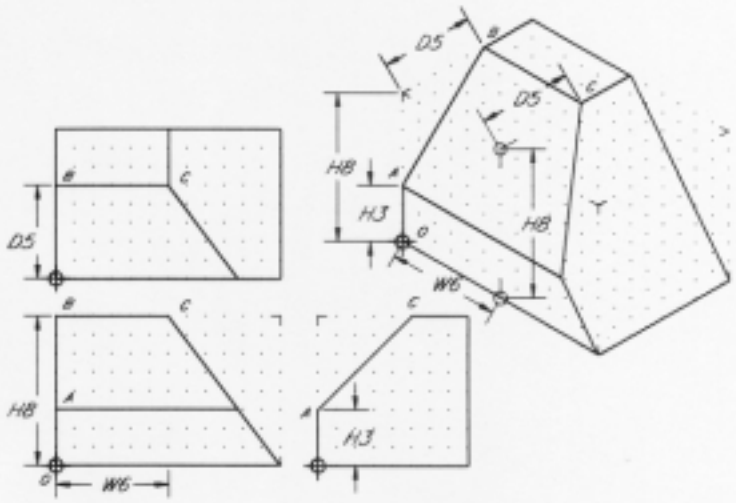


Inclined Surfaces in Pictorial Views

Points on pictorial views may require 1, 2, or 3 measurements to locate.

Working from the lower left corner (0,0) of the object, points are measured using HEIGHT, WIDTH and DEPTH:

__point A is 3 units above O (H3).
__point B is 8 units up and 5 units back (H8,D5).
__point C is 6 units to the right, 8 units up and 5 units back. (W6, H8, D5).



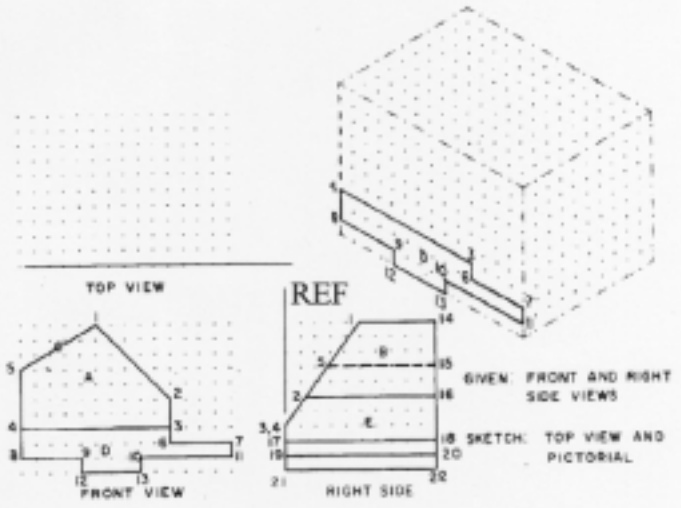
Problem Solution:

Sketch a horizontal line in the top view and a vertical line in the side view for measurements.

Inclined line 1,4 in the side view is surface 1,2,3,4,5 in the front view.

__Number the corners in the front view.
__Transfer the numbers back to the side view.

You must know exactly where each corner of the surface is .. in BOTH given views.

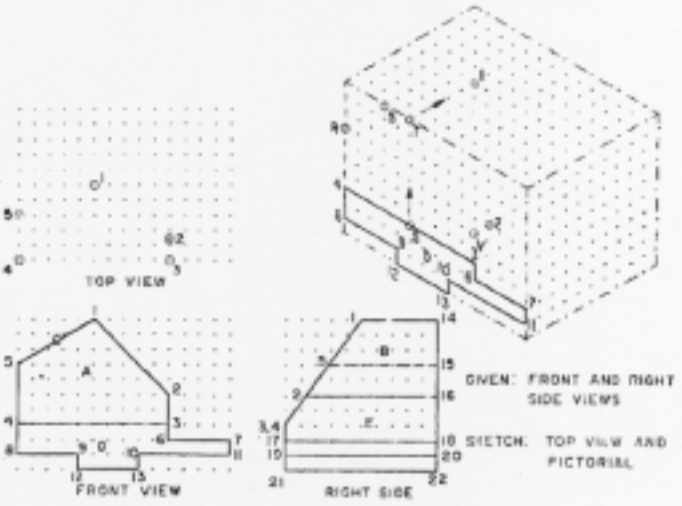


Transfer the points to the top view:

__3 and 4 project up. Both are on the front face, zero distance measurement.
__5 projects from the front. 5 is 3 units depth.
__1 projects from the front. 1 is 5 units depth,
__2 projects from the front, 2 is 1 1/2 units depth.

Transfer the points to the pictorial:

__3 and 4 are already shown.
__5 is 4 units above 4 and 3 units back. (4H and 3D relative to 4).
__1 is 5 units width, 10 units height and 5 units depth from the lower left corner of the grid. (5W, 10H and 5D)
__2 is 2 units up and 1 1/2 units back from 3. (2H and 1 1/2D relative to 3).

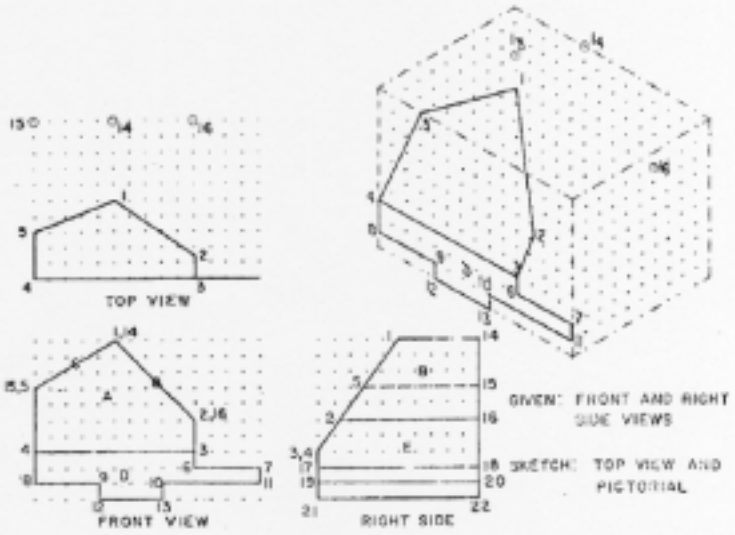


Connect the points 1,2,3,4,5,1 in order. This locates surface "A".

Inclined line "B" in the front view is surface 1,14,16,2 in the side view.
__transfer 1,14 to 1 in the front view.
__transfer 2,16 to 2 in the front view.

__project 14 to the top view. 14 measures 10 units depth (back of the object).
__project 16 to the top view. 16 also measures 10 units depth.

Plot 14 and 16 on the pictorial:
__14 is 5 units in back of 1.
(5D relative to 1).
__16 is 8 1/2 units deep relative to 2.
(8 1/2D relative to 2).
Connect 1,14,16,2,1 to complete the surface.



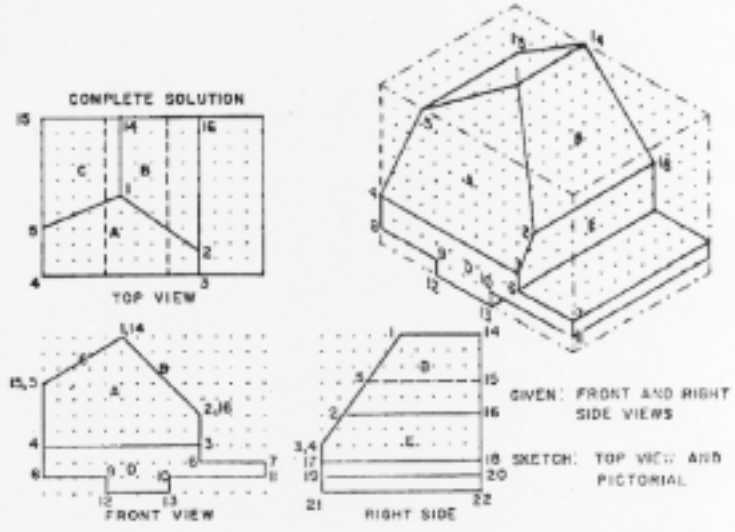
Finish the drawing.

Inclined line "C" in the front view is surface 1,14,15,5 in the side view. Project point 15 to the front view. Locate point 15 in the top view. 15 projects from the front and measures 10 units depth from the side view. Draw surface 1,14,15,5,1 in the top view.

Locate point 15 in the pictorial view. 15 is 7 units depth relative to 5. Draw surface 1,14,15,5,1 in the isometric.

Horizontal edge-of-surface 6,7 in the front view is horizontal edge-of-surface 17,18 in the side view.
__Sketch a surface in the top view 4 units wide and 10 units deep.
__Sketch the surface on the pictorial view.

Vertical edge-of-surface 10,13 in the front view is normal surface 19,20,22,21 in the side view. Sketch a vertical hidden line in the top view directly above 10,13 and extending from front to back (10 units).



Vertical edge-of surface 9,12 in the front view is a hidden surface behind 19,20,22,21 in the side view. Sketch a vertical hidden line in the top view directly above 9,12 and 10 units deep.

NAME

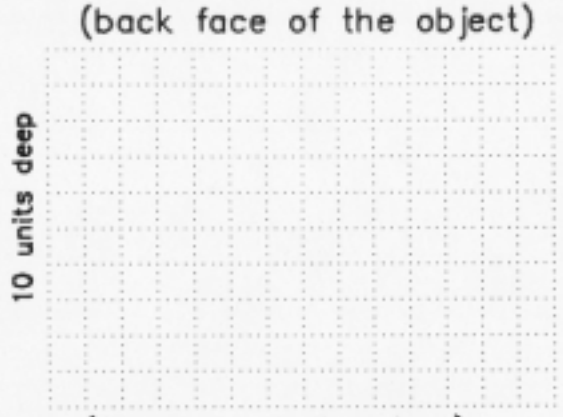
DATE

FILE NUMBER

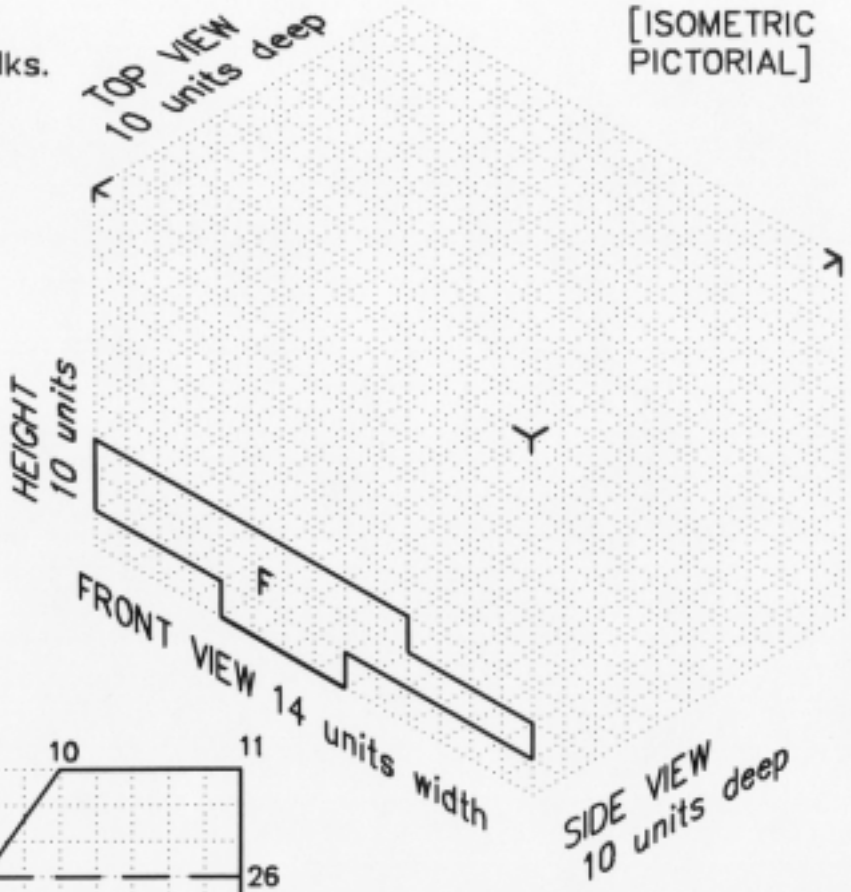
GRADE

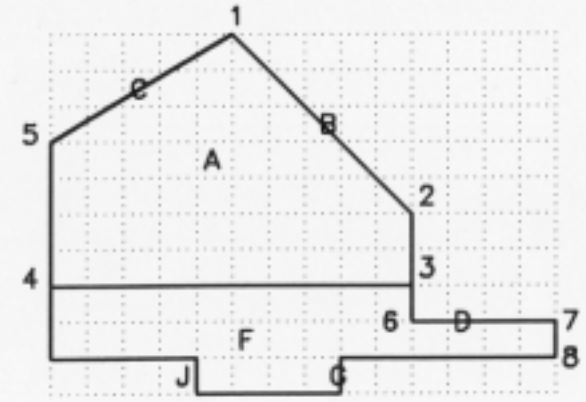
INCLINED SURFACE LECTURE SHEET

Please sketch the answer as the instructor talks.
Follow the reasoning used to prove
every line and point on the drawing.

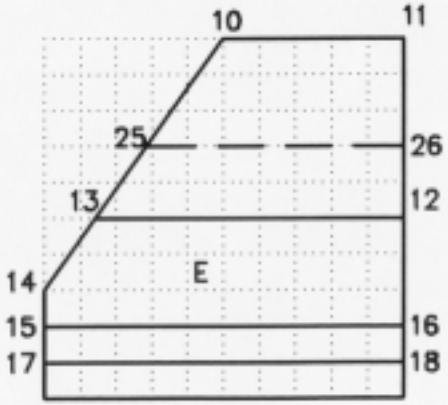


[TOP VIEW]





[FRONT VIEW]



[RIGHT SIDE VIEW]
10 units deep

NOTE:
Show hidden lines in orthographic views.
Do not show hidden lines in pictorial views.

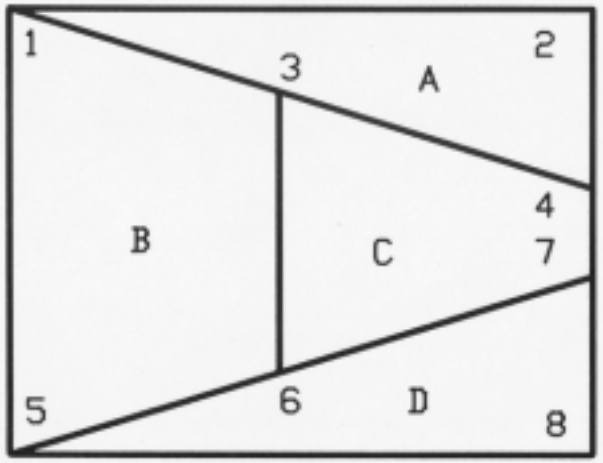
INCLINED SURFACE LECTURE SHEET	DRAWN BY:	DATE	COURSE	GRADE	DRAWING

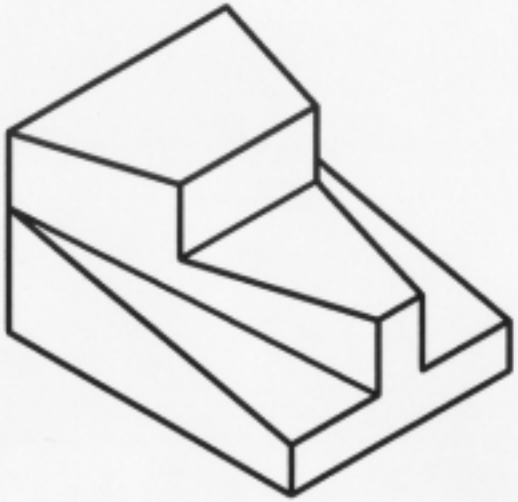
NAME

DATE

FILE NUMBER

GRADE

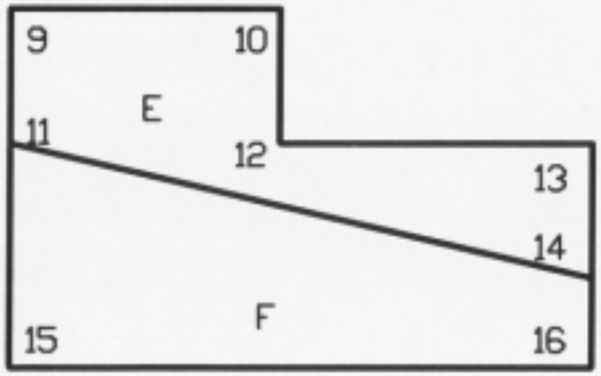


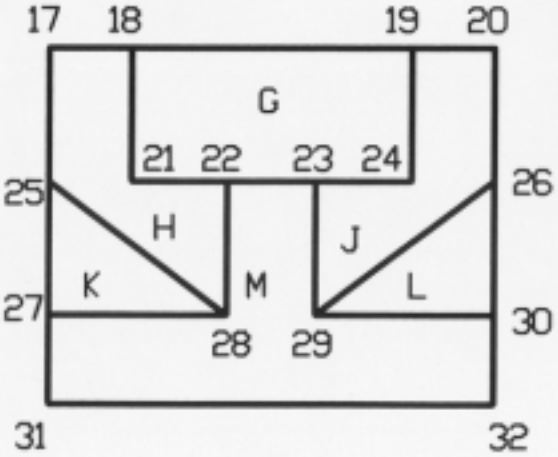


USE A SINGLE LETTER TO ANSWER WHENEVER POSSIBLE.

FRONT	TOP	SIDE
E		
F		
	A	
	B	
	C	
	D	
		G
		H
		J
		K
		L
		M

NEATLY LETTER.

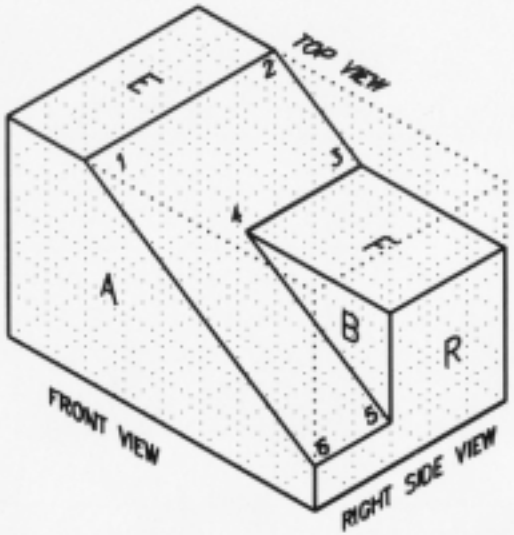




I-1 INCLINED SURFACES | NAME : | DATE : : : : : : : :

FILE NUMBER .....

GRADE



NOTE: Number corners
1,2,3,4,5,6 in all views.

TOP VIEW

REAR (BACK) VIEW

LEFT SIDE VIEW

FRONT VIEW

RIGHT SIDE VIEW

GIVEN: ISOMETRIC PICTORIAL VIEW.
SKETCH THE SIX REGULAR
ORTHOGRAPHIC VIEWS.
Be sure to show hidden lines
in the orthographic views.

LABEL SURFACES IN ALL VIEWS.

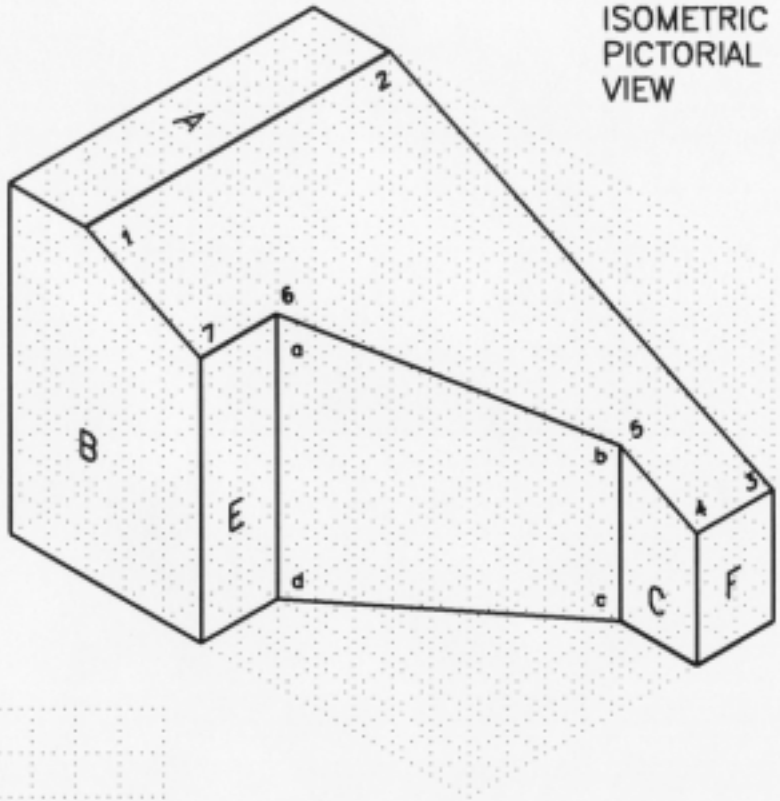
BOTTOM VIEW

I–2 INCLINED SURFACES	NAME	DATE .....

FILE NUMBER ..... GRADE

LABEL SURFACES, NUMBER CORNERS WHEN INDICATED.

ISOMETRIC PICTORIAL VIEW



GIVEN: ISOMETRIC PICTORIAL VIEW.
SKETCH FRONT TOP AND SIDE VIEWS.
LABEL CORNERS AND SURFACES AS SHOWN.

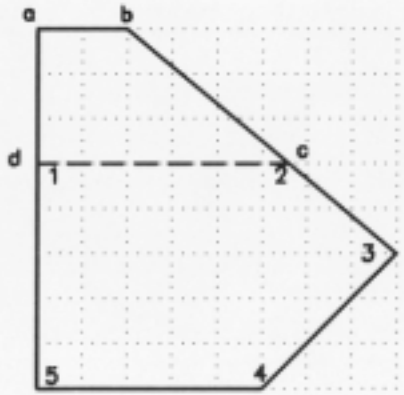
ORTHOGRAPHIC VIEWS

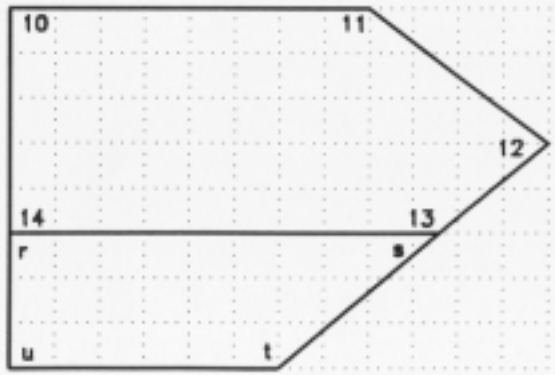
I–3 INCLINED SURFACES	NAME	DATE .....

FILE NUMBER ..... GRADE

ISOMETRIC
PICTORIAL
VIEW

LABEL SURFACES, NUMBER CORNERS
WHEN INDICATED.





GIVEN: LEFT SIDE AND
FRONT VIEWS ARE COMPLETE.
SKETCH TOP VIEW AND
ISOMETRIC PICTORIAL VIEWS.
LABEL CORNERS IN ALL VIEWS
USING THE NUMBERS AND
LETTERS SHOWN.

ORTHOGRAPHIC VIEWS

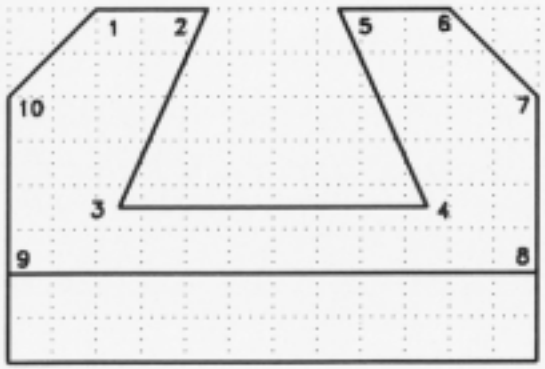
I–4 INCLINED SURFACES	NAME	DATE .....

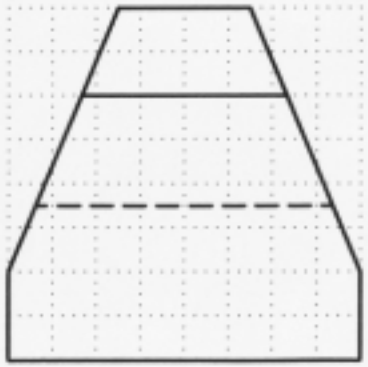
FILE NUMBER

GRADE

LABEL SURFACES, NUMBER CORNERS WHEN INDICATED.

ISOMETRIC PICTORIAL VIEW





GIVEN: FRONT AND RIGHT SIDE VIEWS ARE COMPLETE.
SKETCH TOP AND ISOMETRIC PICTORIAL VIEWS.
LABEL CORNERS AS SHOWN.

ORTHOGRAPHIC VIEWS

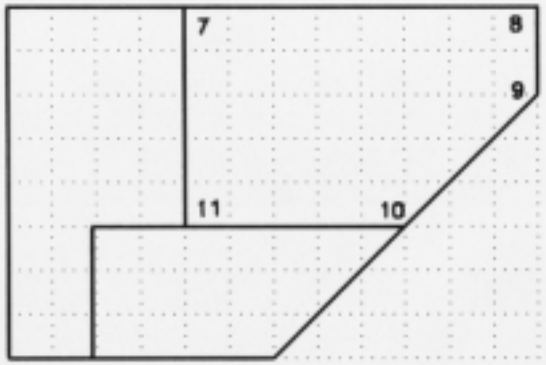
I–5 INCLINED SURFACES.	NAME	DATE

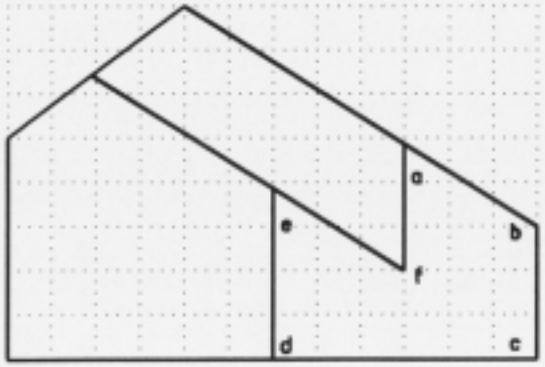
FILE NUMBER .....

GRADE

LABEL SURFACES, NUMBER CORNERS WHEN INDICATED.

ISOMETRIC PICTORIAL VIEW





GIVEN: FRONT AND TOP VIEWS ARE COMPLETE.
SKETCH RIGHT SIDE AND ISOMETRIC PICTORIAL VIEWS.
LABEL SURFACES AS SHOWN.

ORTHOGRAPHIC VIEWS

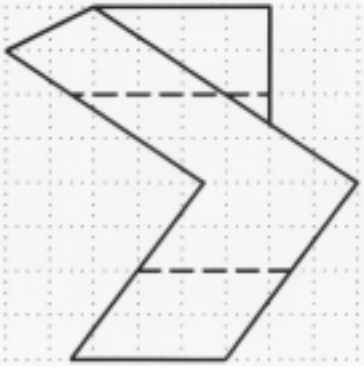
I–6 INCLINED SURFACES	NAME	DATE .....

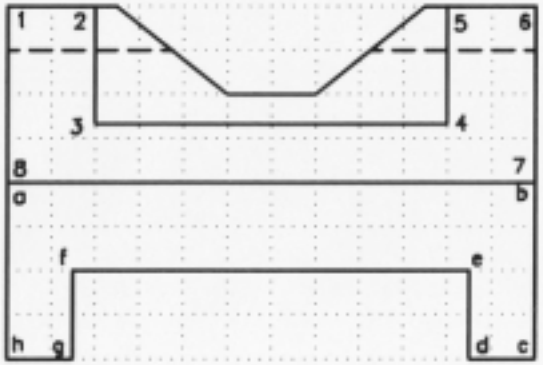
FILE NUMBER ..... GRADE

ISOMETRIC
PICTORIAL
VIEW

LABEL SURFACES, NUMBER CORNERS
WHEN INDICATED.

GIVEN: FRONT AND LEFT SIDE
VIEWS ARE COMPLETE.
SKETCH TOP VIEW AND
ISOMETRIC PICTORIAL VIEW.
LABEL SURFACES AS SHOWN.





ORTHOGRAPHIC VIEWS

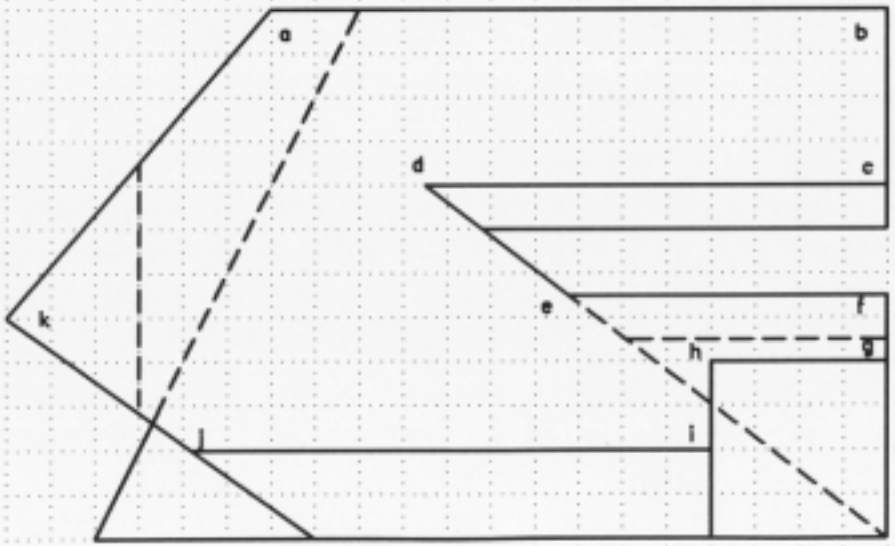
I–7 INCLINED SURFACES	NAME	DATE .....

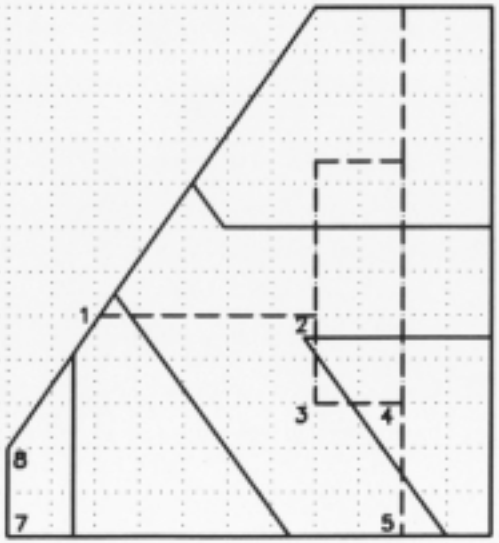
FILE NUMBER

GRADE

TYPICAL EXAM

GIVEN: COMPLETE FRONT AND
RIGHT SIDE VIEWS.
SKETCH TOP VIEW.
SHOW HIDDEN LINES.
LABEL CORNERS.





T–4 INCLINED SURFACE TYPICAL EXAM	NAME	DATE

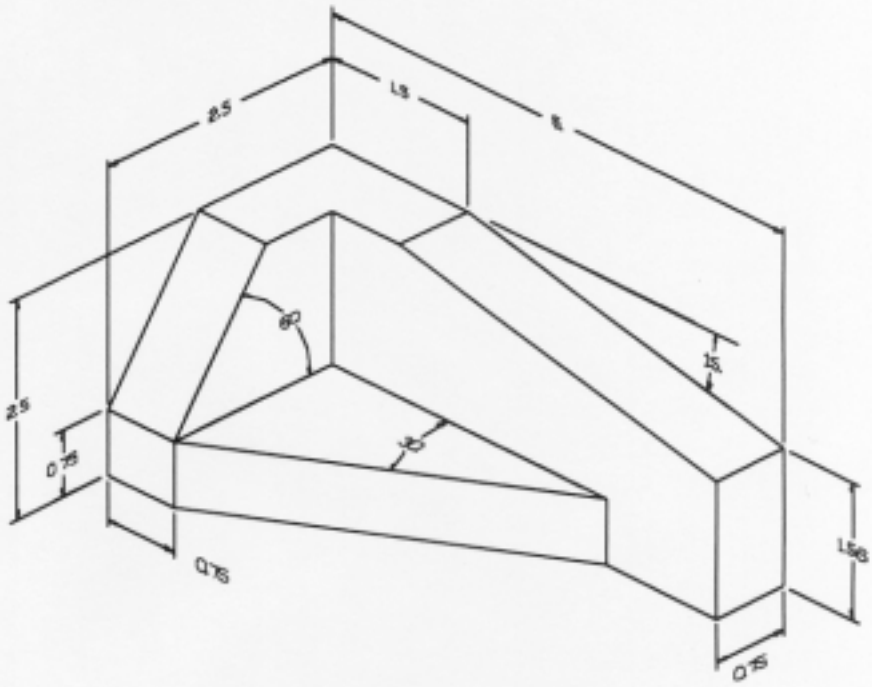
Inclined Surface Layout Drawings

Problem I-20

(Dimensions shown may not reflect good placement or good dimensioning practice.)

Draw three views.

Dimension using correct form and placement if required.

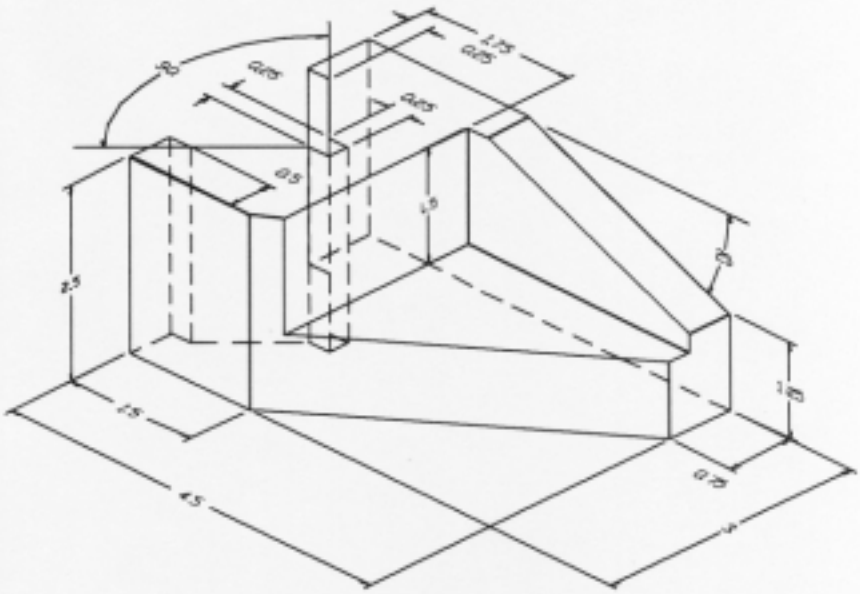


Problem I-21

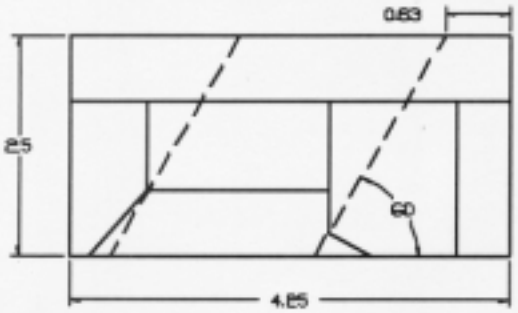
(Dimensions shown may not reflect good dimensioning form or practice.)

Draw three views.

Dimension using correct form and placement if required.

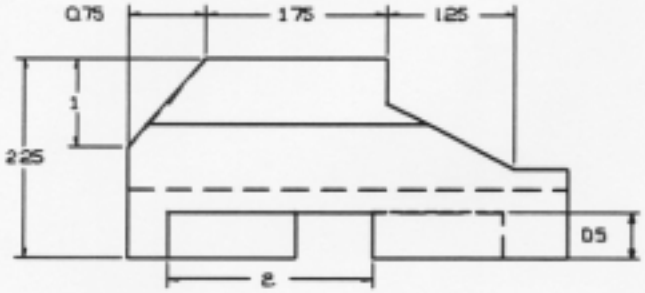


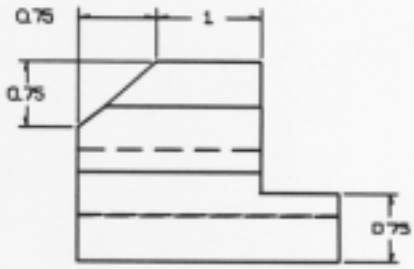
Inclined Surface Pictorial Layout Drawings.



Problem I-30

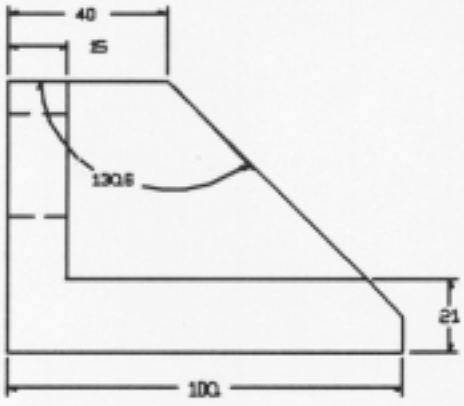
Draw Isometric (or other) pictorial as assigned.

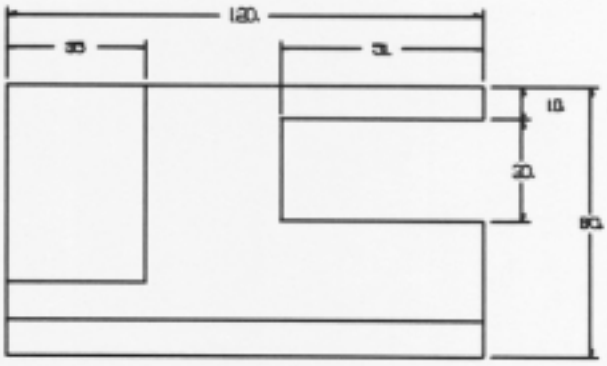




Problem I-31.

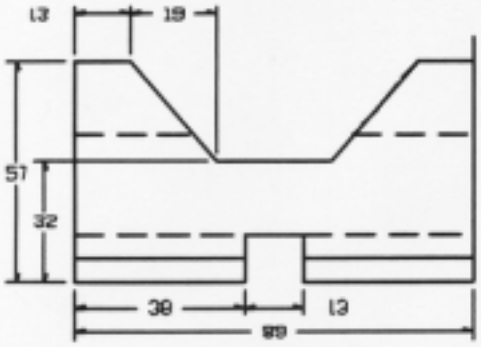
Draw Isometric (or other) pictorial as assigned.

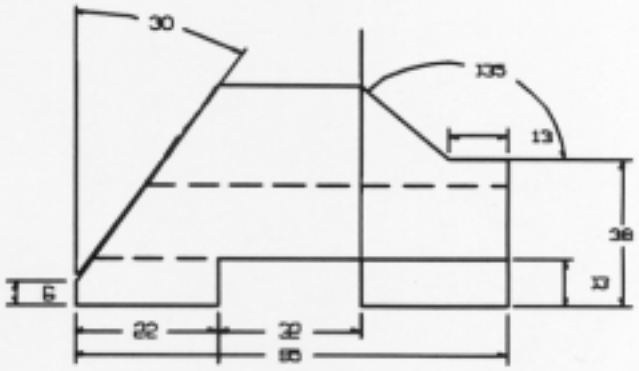




Problem I-32.

Draw Isometric (or other) pictorial view as assigned.





Problem I-33.

Draw Isometric (or other) pictorial as assigned.